

### **REMARKS**

Applicants respectfully request that the Amendment and Response to Final Office Action be admitted under 37 C.F.R. 1.116. Applicants submit that this amendment presents claims in better form for consideration on appeal. Furthermore, applicants believe that consideration of this amendment could lead to favorable action that would remove one or more issues for appeal. Applicants submit that thus there is good and sufficient reason why this amendment should be admitted now. Reconsideration of this application, as amended, is respectfully requested.

Claims 1, 3, 5-17, 19-22 and 26-29 are pending. Claims 1, 3, 5-17, 19-22 and 26-29 stand rejected.

Claims 1, 8, 14, 19, 26 and 28 have been amended. Claims 20-22 and 29 have been cancelled. Claims 30 and 31 have been added. Support for the amendments is found in the specification, the drawings, and in the claims as originally filed. Applicants submit that the amendments do not add new matter.

### **Restriction Requirements**

The Office Action has required restriction to one of the inventions in this application under 35 USC §121. The Applicants affirm election to prosecute claims 1, 3, 5-17, 19-22 and 26-28, without traverse, and have cancelled claim 29.

### **Specification**

The specification has been objected to as failing to provide proper antecedent basis for the claimed subject matter. The Examiner states:

Correction of the following is required: the claimed subject matter of “a fusible filler randomly positioned within the binder material and a plurality of non-fusible particles randomly positioned within the binder material”; “the non-fusible particles comprise a plurality of irregularly shaped particles” and “the binding material is not adhesive” are not described in the specification.

In regard to the terms “a fusible filler randomly positioned within the binder material and a plurality of non-fusible particles randomly positioned within the binder material” and “the non-fusible particles comprise a plurality of irregularly shaped particles,” applicants have amended the specification and the claims so that claimed subject matter is described in the specification.

In regards to the term “the binding material is not adhesive,” the claims have been amended so that claimed subject matter is described in the specification.

### **Rejections Under 35 U.S.C. § 112**

The Examiner has rejected claims 1, 3, 5-17, 19-22 and 26-28 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The Examiner has stated that

The claims contain subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. The claimed subject matter of “a plurality of fusible filler randomly positioned within the binder material” is not described in the original disclosure. In contrast, applicant discloses in figure 4, that the fusible filler has to be located in such a way that they are in surrounding or coating the non-fusible material. Therefore, the fusible filler has to be positioned non-randomly within the binder material. As regarding claim 26, the claimed subject matter of “the non-fusible particles comprise a plurality of irregularly shaped particles” is not supported in the original disclosure. As regarding claim 28, the claimed subject matter of “the bonding material in non-adhesive” is not supported in the original disclosure. The original disclosure describes in claim 7 that the binder material acts as an adhesive.

(p. 3-4, Office Action 8/26/03)

In response, applicants have amended the specification and the claims as discussed above so that the written description reasonably conveys that the inventors had possession of the claimed invention.

The Examiner has rejected claims 8, 14, 19 and 26 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner has stated that

Claims 8, 14 and 19 depend on claim 2, which has been cancelled. Therefore, it is not clear what the scopes of these claims are. As regarding claim 26, the claimed subject matter of “the non-fusible particles comprise a plurality of irregularly shaped particles” renders the scope of the claim indefinite since it is not clear what shape applicant is claiming because it is not known in the art or defined in the specification what shape is irregularly shape.

(p. 4, Office Action 8/26/03)

In response applicants have amended the claims to provide proper dependency in regard to claims 8, 14, and 19, and applicants have amended the specification and the claims as discussed above in regard to claim 26 .

#### **Rejections Under 35 U.S.C. 102(b)**

Claims 1, 3, 5-7, 9-10, 15-17, 20-22 and 27-28 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,059,952 of Kang, et al. (“Kang”). The Examiner stated that

Kang discloses (figure 3, and column 5, lines 10-18) that a thermal interface material comprising a polymer paste material (polymer); a fusible filler (tin) coated onto a plurality of non-fusible particles (Cu); and the pre-coated non-fusible particles randomly positioned within the binder material. Kang further discloses (column 5, lines 10-18 and column 6, lines 31-34) that the fusible filler can be Sn, In, Bi, Sb and their alloys while the non-fusible particles can be silver. It is well known in the art that tin has a melting point at 120C degrees, indium at 159 degrees and copper or silver has thermal conductivity greater than the thermal conductivity of tin. As regarding claim 16, Tin and Indium, which are the materials, selected to use as the claimed fusible material. Therefore, it is inherently that either tin or indium to have the property such as “stable to oxygen at temperature up to approximately 150C and relative humidity up to approximately 90%”. Kang further discloses (column 9, lines 57-64, and claim 19) that the polymer can be both adhesive and non-adhesive and the relative amount of the filler powder over the polymer binder varied from 30 to 90% in weight depending on a specific application.

Toyota discloses (figures 1-3, and table 4) that a thermal interface material that has a conductive filler (2) embedded within an adhesive material (1) wherein the conductive filler comprises of a non-fusible particle of silver (20) and a solder alloy (21) coated on the particle (20). The solder alloy is selected to be a combination of Bi (57%) and Sn (43%) in order to obtain a melting temperature of 139 degrees (C).

(p. 5-6, Office Action 8/26/03)

Applicants respectfully submit that 1, 3, 5-7, 9-10, 15-17, and 27-28 are not anticipated by Kang. Claim 1 includes the following limitations.

A thermal interface material, comprising:  
a binder material;  
a fusible filler within the binder material, the fusible filler randomly positioned with respect to the binder material; and  
a plurality of non-fusible particles having a mean diameter of approximately 25 microns within the binder material, the non-fusible particles randomly positioned with respect to the binder material.

(Amended Claim 1) (Emphasis added)

Kang does not disclose non-fusible particles, but instead a conductive powder (e.g., copper powder). The terms “fine powder” and “spheroidal copper powder nominally 5 to 7 micron diameter” indicate the size and shape of the particles. Kang does not disclose particles having a mean diameter of 25 microns.

Moreover, the function of the particles of Kang (i.e., to render the paste electrically conductive) necessitates that the particles, when fused, extend throughout the paste such that the particles can fuse to electrically conductive surfaces to form electrical interconnections. This means that the particles are not “randomly positioned,” but are positioned so as to form an electrical connection through the paste.

The function of the invention is a thermal interface and therefore no such constraint is placed upon the particles, which are randomly positioned with respect to the binder material.

For these reasons applicants respectfully submit that claim 1 is not anticipated by Kang. Given that claims 3, 5-7, 9-10, 15-17, and 27-28 depend, directly or indirectly, from claim 1, applicants respectfully submit that claims 3, 5-7, 9-10, 15-17, and 27-28 are, likewise, not anticipated by Kang.

**Rejections Under 35 U.S.C. § 103(a)**

Claims 11-13 stand rejected under 35 U.S.C. § 103 as being obvious over U.S. Patent No. 6,059,952 of Kang, et al. (“Kang”).

The Examiner has rejected claims 11-13 under 35 U.S.C. § 103 as being obvious over U.S. Patent No. 6,059,952 of Kang, et al. (“Kang”). The Examiner has stated that

Kang substantially discloses all of applicant’s claimed invention as discussed above except for the limitation regarding the physical composition of the thermal interface material. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the claimed range of physical composition such as weight and volume between the fusible and the non-fusible particle in view of Kang’s physical composition of the fusible and non-fusible particle, since it has been held that where the general condition of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. Furthermore, at the time the invention was made, it would have been an obvious matter of design choice to a person of ordinary skill in the art to obtain the claimed range of physical composition between the fusible and non-fusible with the thermal interface material because applicant has not disclosed that the claimed physical range of weight and volume between the fusible and non-fusible, provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected applicant’s invention to perform equally well with the physical composition between the fusible and non-fusible material of Kang because Kang’s fusible filler has a sufficient amount to completely coat over the non-fusible material.

(p. 6-7, Office Action 8/26/03)

Applicants respectfully disagree with the Examiner in regard to the obviousness of the claimed range of physical composition of the material. The disparate function of the high conductivity paste (i.e., high electrical conductivity paste) of Kang and the thermal interface material of the claimed invention renders such analysis far from obvious. Kang will not function without a completed conductive interconnection and therefore goes through great effort to ensure that the conductive particles (copper powder) are coated sufficiently to ensure a fusion that

results in such an interconnection. In contrast, the thermal interface material as claimed does not require such fusion.

Contrary to the Examiner's statement that the applicant has not disclosed that the claimed physical range of weight and volume between the fusible and non-fusible, provides an advantage, the specification discloses that the non-fusible particles can provide the highest thermal conductivity while the fusible material connects the adjacent particles. Therefore, the specification discloses the advantage of providing as many non-fusible particles as possible while maintaining enough fusible filler to connect them.

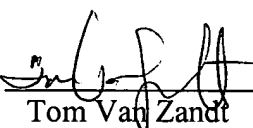
Moreover, Kang does not include the limitations of claims 11 – 13 through their direct or indirect dependency upon claim 1 as discussed above.

For these reasons applicants respectfully submit that claims 11 – 13 are not obvious under 35 U.S.C. § 103 in view of Kang.

It is respectfully submitted that in view of the amendments and arguments set forth herein, the applicable rejections and objections have been overcome. If there are any additional charges, please charge Deposit Account No. 02-2666 for any fee deficiency that may be due.

Respectfully submitted,

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